## REMARKS

In view of the above amendments and the following remarks, reconsideration and further examination are requested.

The specification and abstract have been reviewed and revised to make a number of editorial revisions. Due to the number of changes involved, a substitute specification and abstract have been prepared and are submitted herewith. No new matter has been added. Enclosed is a marked-up copy of the specification and abstract indicating the changes incorporated therein.

The original Declaration has been indicated as being defective for failing to include the city of the inventor. A newly signed substitute Declaration is enclosed herewith listing the inventor's city. As a result, withdrawal of this requirement is respectfully requested.

Figure 7 of the drawings has been objected to as not being labeled as "Prior Art." Enclosed herewith are substitute formal drawings including an amendment to Figure 7 labeling it as prior art as required. No new matter has been added by this amendment to Figure 7. As a result, withdrawal of this objection is respectfully requested.

Claims 1-3, 10, 12 and 14 have been rejected under 35 U.S.C. §102(b) as being anticipated by Stoklosa (US 4,920,019). Claims 4-8, 11 and 13 have been rejected under 35 U.S.C. §103(a) as being unpatentable over Stoklosa in view of Hope (US 5,422,200). Claim 9 has been rejected under 35 U.S.C. §103(a) as being unpatentable over Stoklosa in view of Nortoft (WO 00/41253).

Claim 1 has been amended to include limitations similar to those originally presented in claim 2. Claim 2 has been amended so as to include some of the limitations originally presented in claim 3. Claim 4 has been amended to be dependent from claim 2 and so as to further define the invention as recited in claim 2. Claims 5 and 7 have been amended so as to further define the invention as recited in claims 2 and 1, respectively. Further, claim 5 and 7-12 have been amended to change their dependencies.

Claims 3 and 14-20 have been canceled without prejudice or disclaimer to the subject matter contained therein.

In addition, claims 1, 2 and 4-13 have been amended to make a number of editorial revisions. These revisions have been made to place the claims in better U.S. form. None of these amendments have been made to narrow the scope of protection of the claims, nor to address issues related to

patentability and therefore, these amendments should not be construed as limiting the scope of equivalents of the claimed features offered by the Doctrine of Equivalents.

Further, new claims 21-26 have been added.

The above-mentioned rejections are submitted to be inapplicable to the claims for the following reasons.

Claims 1 is patentable over Stoklosa, since claim 1 recites a battery unit having, in part, a holding plate on which a plurality of battery cells are fixed, and a common circuit board which is separate from the holding plate, wherein pairs of lead plates of the plurality of battery cells are connected to the common circuit board. Stoklosa fails to disclose or suggest these features of claim 1.

Stoklosa discloses a battery pack assembly having a circuit board 10 (integral structure 40) formed of a lower insulation sheet 12, an intermediate metal foil layer 16, and an upper insulation sheet 14 laminated together. The integral structure 40 is formed such that a number of tabs 25 of the intermediate metal foil layer 16 extend into openings 20 and 22 of the lower insulation sheet 12 and the upper insulation sheet 14, respectively. The positive and negative terminals of a number of batteries can be attached (spot welded) to the respective tabs 25 in order to connect the batteries to the intermediate metal foil layer 16 and form the battery pack. (See column 2, lines 26-35; column 4, lines 36-51; and Figures 1-3, 7 and 8).

It is noted that the rejection indicates that either the lower insulation sheet 12 or the upper insulation sheet 14 corresponds to the holding plate of claim 1. Further, the rejection indicates that the intermediate metal foil layer 16 corresponds to the common circuit board recited in claim 1. However, while Stoklosa does disclose that the positive and negative terminals of a number of batteries are connected to the tabs 25 of the intermediate metal foil layer 16, Stoklosa fails to disclose or suggest that the batteries are fixed to either the upper insulation sheet 14 or the lower insulation sheet 12 as is the case with the holding plate in claim 1. Further, it is apparent that the intermediate metal foil layer 16, the upper insulation sheet 14 and the lower insulation sheet 12 are integrally formed as the integral structure 40 and not separate from each other as is the case with the common circuit board and the holding plate in claim 1. As a result, Stoklosa fails to disclose or suggest the present invention as recited in claim 1.

As for (1) Hope and (2) Nortoft, these references are relied upon as disclosing (1) a plurality of flat alkali metal battery cells, and (2) a holding plate having an area equal to an area of a plurality of battery cells laid side by side. However, even if these references do, in fact, disclose these features, neither of the references discloses or suggests the features of claim 1 discussed above.

Claim 2 is patentable over Stoklosa, since claim 2 recites a battery installation housing including, in part, a bottom plate having at least one rib projecting therefrom, and a holding plate on which a plurality of battery cells are fixed, the holding plate having at least one hole formed therein, the at least one hole being positioned between a pair of the plurality of battery cells, wherein the at least one rib passes through the at least one hole of the holding plate. Stoklosa fails to disclose or suggest these features of claim 2.

As discussed above, Stoklosa discloses the circuit board 10 formed of the lower insulation sheet 12, the intermediate metal foil layer 16, and the upper insulation sheet 14 laminated together with the tabs 25 of the intermediate metal foil layer 16 extending into the openings 20 and 22 of the lower insulation sheet 12 and the upper insulation sheet 14, respectively. The positive and negative terminals of a number of batteries can be attached (spot welded) to the respective tabs 25 in order to connect the batteries to the intermediate metal foil layer 16 and form the battery pack. (See column 2, lines 26-35; column 4, lines 36-51; and Figures 1-3, 7 and 8).

Stoklosa also discloses that a number of alignment holes 26, 28 and 30 are located in the outer periphery of the lower insulation sheet 12, the intermediate foil layer 16, and the upper insulation sheet 14, respectively, which can have pins inserted therein to ensure that the three layers are properly aligned prior to lamination. In another embodiment, some of the alignment holes 26, 28 and 30 are replaced with protrusions which can be inserted into the remainder of the alignment holes 26, 28 and 30. (See column 4, lines 10-24 and Figures 1, 2 and 3).

It is apparent that the alignment holes 26, 28 and 30 do not correspond to the at least one alignment hole recited in claim 2, since the at least one alignment hole is recited as being positioned between a pair of battery cells. As can be seen from Figures 1, 2 and 3, the alignment holes 26, 28 and 30 are all located along the peripheries of the lower insulation sheet 12, the intermediate foil layer 16, and the upper insulation sheet 14, respectively, and are not located between a pair of batteries. Further, while Stoklosa does disclose an embodiment that replaces some of the alignment holes 26,

28 and 30 with protrusions which can be inserted into the remainder of alignment holes 26, 28 and 30, there is no disclosure of a bottom plate having at least one rib that passes through at least one hole in either of the lower insulation sheet 12 or the upper insulation sheet 14.

Further, Stoklosa discloses a third set of connection orifices 32 and 34 located in the lower insulation sheet 12 and the upper insulation sheet 14, respectively, which allow for additional circuit components to be electrically connected to the intermediate foil layer 16. As can be seen from Figure 5, the third set of connection orifices 32 and 34 expose portions of the intermediate foil layer 16 and some of the connection orifices 32 and 34 appear to be located between batteries. (See column 3, lines 24-37 and Figures 1, 3 and 5). However, it is also apparent that this portion of Stoklosa fails to disclose or suggest a bottom plate having at least one rib projecting therefrom which passed through at least one of the connection orifices 32 and 34. Instead, as mentioned above, the connection orifices allow for additional connection components to be electrically connected to the intermediate foil layer 16. As a result, Stoklosa fails to disclose or suggest the present invention as recited in claim 2.

As for (1) Hope and (2) Nortoft, these references are relied upon as disclosing (1) a plurality of flat alkali metal battery cells, and (2) a holding plate having an area equal to an area of a plurality of battery cell laid side by side. However, even if these references do, in fact, disclose these elements, neither of the references discloses or suggests the features of claim 2 discussed above.

Because of the above mentioned distinctions, it is believed clear that claims 1, 2, 4-13 and 21-26 are allowable over the references relied upon by the Examiner. Furthermore, it is submitted that the distinctions are such that a person having ordinary skill in the art at the time of invention would not have been motivated to make any combination of the references of record in such a manner as to result in, or otherwise render obvious, the present invention as recited in claims 1, 2, 4-13 and 21-26. Therefore, it is submitted that claims 1, 2, 4-13 and 21-26 are clearly allowable over the prior art of record.

In view of the above amendments and remarks, it is submitted that the present application is now in condition for allowance. The Examiner is invited to contact the undersigned by telephone if it is felt that there are issues remaining which must be resolved before allowance of the application.

Respectfully submitted,

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Version with Markings to Show Changes Made



# ASSEMBLED BATTERY UNIT AND MANUFACTURING METHOD THEREOF

## BACKGROUND OF THE INVENTION

### 1. Field of the Invention

**[0001]** The present invention relates to an assembled battery unit in which a plurality of battery cells are connected to a circuit board.

### 2. Description of the Prior Art

**[0002]** For example, a lithium-polymer secondary battery uses a gel-form polymer electrolyte, and has characteristics of a high degree of freedom of shape, small thickness, and light weight. Therefore, it has been used for a cellular phone and various types of portable information communication equipment such as a notebook personal computer.

**[0003]** In the case where the lithium-polymer secondary battery is used for portable information communication equipment, etc., although a single battery cell is sometimes used ~~singly~~, a plurality of battery cells are often formed into an assembled battery unit 53, for example, as shown in FIG. 7, together with a protective circuit, etc. according to the necessary voltage and electric capacity of the equipment.

**[0004]** However, since a lead plate 50 of a battery cell 55 is formed of a thin metal piece, when ~~an~~ the assembled battery unit 53 is installed into portable information communication equipment, etc., the battery cell 55 moves up and down undesirably and thus, it is difficult to install the assembled battery unit 53 in a housing. Needless to say, it is conceivable that the installation is made easy by housing the assembled battery unit 53 in a casing made of a plastic material or the like. In this case, however, the assembled battery unit 53 becomes heavy due to the weight of the casing. Also, in the work for assembling the assembled battery unit 53, it is difficult to connect the lead plate 50 to a circuit board 56 because the battery cell 55 moves up and down undesirably. .

[0005] The present invention has been accomplished in view of the above situation, and accordingly, an object thereof is to provide an assembled battery unit such that the work for installing the assembled battery unit in a housing and assembling the battery unit itself can be performed easily.

## SUMMARY OF THE INVENTION

[0006] An assembled battery unit in accordance with the present invention has a plurality of battery cells and one holding plate, and the battery cells are fixed on the holding plate.

[0007] In the assembled battery unit constructed as described above, the battery cells are fixed on one holding plate. In the case of the above-mentioned assembled battery unit construction, for example, when the assembled battery unit is incorporated in information communication equipment, etc., individual battery cells do not move up and down when the holding plate is held by hand, so that the work for installing the assembled battery unit in a housing can be performed easily. Also, since the assembled battery unit is not housed in a casing, but is fixed by one holding plate, the assembled battery unit can be housed in the housing for information communication equipment, etc. in a compact form.

[0008] Further, in a case where lead plates ~~led~~ leading out of the battery cell are connected to a common circuit board, the lead plates must be connected to the common circuit board. In this case, individual battery cells do not move up and down when the holding plate is held by hand, so that the work for installing the circuit board can be performed easily.

[0009] Further, if the holding plate is formed with a slit at a position between the battery cells, the slit serving to fit a positioning rib, which is provided on the housing for equipment in which the assembled battery unit is incorporated, therein, the effects described below are achieved. When the assembled battery unit is installed in the housing for equipment, the rib fits in the slit, so that the assembled battery unit can be installed at a

proper position in the housing. Also, since the slit is located between the battery cells, the projecting portion of the rib is put in a gap between one battery cell and an adjacent battery cell. Therefore, a special housing space for housing the rib need not be provided.

**[0010]** Also, if the battery cell is a thin battery cell, the battery cell is difficult to hold by hand, and the work for installing the circuit board and the work for installing the assembled battery unit in the housing are difficult to ~~do~~ perform. However, according to the assembled battery unit in accordance with the present invention, either work can be performed easily.

**[0011]** Also, in a manufacturing method for the assembled battery unit in accordance with the present invention in which the lead plates ~~led~~ leading out of the battery cells are connected to the common circuit board, after the battery cells are fixed on the holding plate, the lead plates of the battery cells are connected to the circuit board. Therefore, the circuit board can be connected easily in a state in which the battery cells are fixed on one holding plate without the individual up and down movement of the battery cells.

**[0012]** Further, if the battery cells are fixed on the holding plate in a state in which the holding plate is set in a jig, the holding plate is formed with a slit for fitting a positioning rib provided on the jig therein at a position between the battery cells, and the battery cells are positioned and fixed between the rib, the effect described below is achieved. In this manufacturing method, if the holding plate is placed in the jig, the positioning rib of the jig projects from the top surface of the holding plate, and the interval of the positioning ribs is equal to the width of the battery cell. Therefore, the positioning of the battery cell can be performed accurately and easily merely by placing the holding plate so that the battery cell can be set between the ribs.

## BRIEF DESCRIPTION OF THE DRAWINGS

**[0013]** FIG. 1 is a partially broken perspective view of a notebook personal computer;

**[0014]** FIG. 2 is a sectional view taken along a line A-A of FIG. 1;

**[0015]** FIG. 3 is a perspective view of an assembled battery unit;

**[0016]** FIG. 4 is an explanatory view showing a manufacturing method for an assembled battery unit;

**[0017]** FIG. 5 is a sectional view showing another embodiment of the present invention;

**[0018]** FIG. 6 is a sectional view showing still another embodiment of the present invention; and

**[0019]** FIG. 7 is a perspective view of a conventional assembled battery unit.

## DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

**[0020]** An embodiment of the present invention will be described in detail with reference to FIGS. 1 to 4. FIG. 1 shows a whole of a notebook personal computer 1 in which an assembled battery unit 3 of this embodiment is incorporated. This assembled battery unit 3 is incorporated in a battery installation housing (housing for equipment) 7 disposed at the back of a crystal liquid member 6 of a liquid crystal display member 5 for the notebook personal computer 1. As described later, the assembled battery unit 3 includes one holding plate 8, a plurality of battery cells 9 fixed collectively to the holding plate 8 with an adhesive, etc., and a circuit board 11 to which lead plates 10a and 10b for positive and negative terminals extending from the battery cell 9 are connected by ultrasonic welding.

**[0021]** FIG. 2 is a sectional view taken along a line A-A of FIG. 1. The liquid crystal display member 5 includes the battery installation housing 7, a lid 22 of which is capable of being opened and closed, and the liquid crystal member 6 fixed on the top surface of the lid 22. In the battery installation housing 7 is housed the assembled battery unit 3. The assembled battery unit 3 is housed so that the battery cells 9 form the upper surface and the holding plate 8 forms the lower surface. The holding plate 8 is fixed to a bottom plate 24 of the battery installation housing 7 with an adhesive tape 21 in such a manner as to be in contact with the bottom plate 24. Also, the holding plate 8 is provided with a linear slit 23

between one battery cell 9 and the adjacent battery cell 9 arranged on the holding plate 8. This slit 23 penetrates the holding plate 8 from the top surface to the bottom surface. On the other hand, the battery installation housing 7 has a positioning rib 25 projecting from the bottom plate 24, and the position of the positioning rib 25 is such that the positioning rib 25 fits in the slit 23 formed in the holding plate 8. The positioning rib 25 fits in the slit 23 in the holding plate 8 so as to pass through the slit 23 in a state in which the assembled battery unit 3 is installed, and a tip end portion 26 of the rib 25 engages with a concave portion 27 provided on the inside of the lid 22 of the battery installation housing 7.

**[0022]** FIG. 3 is a perspective view of the assembled battery unit 3. The battery cell 9 is a substantially rectangular thin battery cell. A thin battery cell means a battery having a small height (H) with respect to the width (W) and depth (D) of the bottom face thereof as shown in FIG. 3. The battery cells 9 are arranged on one holding plate 8 in such a manner that a long side 31 of one battery and a long side 31 of the adjacent battery cell 9 ~~are adjoined~~ adjoin each other, and a gap corresponding to the width of the slit 23 in the holding plate 8 is provided between one battery cell 9 and the adjacent battery cell 9. The holding plate 8 has an area approximately equal to the total area of the battery cells 9 arranged as described above, and has a substantially rectangular shape. On the other hand, the short sides 33 of the battery cells 9 are arranged on the holding plate 8 in such a manner that short sides 33 of the battery cells 9 form one line. Also, on one short side 33 of each of the battery cells 9, the pair of flexible thin lead plates 10a and 10b for positive and negative terminals are led in parallel out of a plane along the bottom surface. The battery cells 9 are fixed on the holding plate 8 so that the lead plates 10a and 10b are located on the same side, and are arranged so that the lead plates 10a and 10b for positive and negative terminals of the adjacent battery cells 9 are arranged alternately. The lead plates 10a and 10b are bonded to the circuit board 11 by soldering. The battery cells 9 are connected in series to each other by lead parts, not shown, of the circuit board 11.

**[0023]** Next, a manufacturing method of the assembled battery unit 3 of this embodiment will be described with reference to FIG. 4. According to this manufacturing method, an assembling jig 41 of a substantially rectangular shallow pan shape is used. A bottom plate 43 of the assembling jig 41 has a substantially rectangular shape slightly larger than the holding plate 8. At the periphery of the bottom plate 43 is erected a side plate 47. At positions which correspond to the slits 23 in the holding plate 8 when the holding plate 8 is superposed on the bottom plate 43, positioning ribs 45 are projectingly provided on the bottom plate 43. The positioning ~~rib~~ ribs 45 ~~is~~ are formed so that in a state in which the holding plate 8 is placed on the bottom plate 43, the positioning ~~rib~~ ribs 45 ~~passes~~ pass through the ~~slit~~ slits 23 in the holding plate 8 and ~~projects~~ project from the top surface of holding plate 8.

**[0024]** In order to manufacture the assembled battery unit 3 by using the assembling jig 41, the holding plate 8 is first placed on the assembling jig 41. By doing this, the ribs 45 of the jig 41 engage with the slits 23 in the holding plate 8, and thus, the holding plate 8 is fixed on the assembling jig 41. The ribs 45 project from the top surface of the holding plate 8 through the slits 23. Next, the first battery cell 9 is placed on the holding plate 8 so that the width thereof is kept between the ribs 45 or between the rib 45 and the side plate 47. The first battery cell 9 is slid in the lengthwise direction so that the short side 33 that is not connected with the lead plates 10a and 10b comes into contact with the side plate 47 of the assembling jig 41.

**[0025]** Then, the next battery cell 9 is placed on the holding plate 8 so as to adjoin the previously placed battery cell 9. The next battery cell 9 is placed in such a manner that the lead plates 10a and 10b thereof are on the same side as those of the previously placed battery cell 9, and the lead plates 10a and 10b for positive and negative terminals of the adjacent battery cells 9 are arranged alternately. By repeating this operation, a plurality of the battery cells 9 ~~in the plural number~~ are arranged on the holding plate 8. If the battery cells 9 are arranged on the holding plate 8 by using the assembling jig 41 in this manner, a width

direction of the battery ~~cell~~ cells 9 is regulated by the ribs 45 and the side plate 47 of the jig 41, and the lengthwise direction thereof is regulated by the side plate 47 of the assembling jig 41. Therefore, the positioning of the battery ~~cell~~ cells 9 on the holding plate 8 can be performed accurately and easily.

**[0026]** In the state in which the battery cells 9 are arranged on the holding plate 8 as described above, the battery cells 9 are fixed to the holding plate 8 with an adhesive, etc., not shown. Thus, the plurality of the battery cells 9 ~~in the plural number~~ are fixed collectively on one holding plate 8. Then, the lead plates 10a and 10b are soldered to the circuit board 11, by which the assembled battery unit 3 is completed. Since the battery cells 9 are collectively fixed on one holding plate 8 as described above, the circuit board 11 can be connected to the lead plates 10a and 10b easily, without the individual up and down movement of the battery cells 9.

**[0027]** The following is a description of a case where the assembled battery unit 3 of this embodiment constructed as described above, is installed in the battery installation housing 7. First, the assembled battery unit 3 is raised while the surface of the holding plate 8 is supported. The assembled battery unit 3 is housed in the battery installation housing 7 so that the ribs 25 of the battery installation housing 7 fit in the slits 23 in the holding plate 8, and the holding plate 8 is fixed on the bottom plate 24 of the battery installation housing 7 with the adhesive tape 21. Thus, for the assembled battery unit 3 of this embodiment, the battery cells 9 can be handled as a unit with the holding plate 8 being used as a support, without the up and down movement of the battery cells 9. Therefore, the assembled battery unit 3 can easily be installed in the battery installation housing 7. Also, since the ribs 25 fit in the slits 23 when the assembled battery unit 3 is installed in the battery installation housing 7, the assembled battery unit 3 can be installed in a proper position in the battery installation housing 7.

**[0028]** The present invention is not limited to the embodiment explained in the above description and drawings. For example, the embodiments described below are also embraced

in the technical scope of the present invention, and further, besides the embodiments described below, various changes and modifications can be made without departing from the spirit and scope of the present invention.

**[0029]** (1) Although the assembled battery unit 3 using the battery cells 9 consisting of lithium-polymer secondary batteries has been described in the above-mentioned embodiment, it is a matter of course that an assembled battery unit consisting of other primary batteries or secondary batteries can be embraced in the present invention.

**[0030]** (2) Although the assembled battery unit 3 installed in the battery installation housing 7 used for a notebook personal computer has been described in the above-mentioned embodiment, it is a matter of course that the assembled battery unit 3 incorporated in other electronic equipment can be embraced in the present invention.

**[0031]** (3) Although the manufacturing method of the assembled battery unit 3 using the assembling jig 41 has been described in the above-mentioned embodiment, it is a matter of course that the battery cells 9 can be fixed directly on one holding plate without the use of the assembling jig 41.

**[0032]** (4) Although the lead plates 10a and 10b of the battery cell 9 have been connected to the circuit board 11 by ultrasonic welding in the above-mentioned embodiment, the connecting method is not limited to this, and it is a matter of course that soldering or spot welding can be performed for the connection.

**[0033]** (5) Although the battery cells 9 having the same shape have been arranged on the holding plate 8 in the above-mentioned embodiment, the configuration of the battery cells is not limited to this, and it is a matter of course that battery cells having a different ~~shape~~ shapes can be arranged on the holding plate 8.

**[0034]** (6) Although the holding plate 8 has been fixed to the battery installation housing 7 with the adhesive tape 21 in the above-mentioned embodiment, for example, as shown in FIG. 5, the construction may be such that elastic engagement claws 7A are

provided on both sides of the battery installation housing 7, and the holding plate 8 is fitted in the elastic engagement claws 7A.

**[0035]** . Also, as shown in FIG. 6, in ~~the~~ a case of a construction in which the battery installation housing 7 is integrated with the lid 22 by threadedly installing screws 30 in a boss 22A of the lid 22, the construction may be such that the holding plate 8 is held between the boss 22A and the bottom plate 24 of the battery installation housing 7 and thereby, fixed to the battery installation housing 7.

**[0036]** (7) Although the holding plate 8 and the circuit board 11 have been formed by separate parts in the above-mentioned embodiment, for example, the circuit board 11 may be made larger so as to be capable of holding the battery cells, and thus, may serve to ~~be provided with a~~ function ~~of serving~~ as a holding plate.